SOP-16

Monitoring Well Water Level Measurement

Yerington Mine Site
Standard Operating Procedure

Revision 0
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SOP-15
GROUNDWATER MONITORING WELL
WATER LEVEL MEASUREMENT

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1.0 OBJECTIVES

The objective of this standard operating procedure (SOP) is to provide the methods to be used for the consistent measurement of groundwater elevations in Site monitoring wells.

2.0 SCOPE AND APPLICABILITY

This procedure is intended for the field acquisition and documentation of monitor well water level data, measured as the depth-to-water from a surveyed reference point elevation. Groundwater levels may be monitored continuously using electronic data loggers and pressure-sensitive transducers, or obtained manually, with a water level indicator or steel surveyor tape, at a prescribed frequency (e.g., weekly, monthly, or quarterly).

During a field investigation, groundwater levels may be obtained in association with monitor well development, purging and sampling, or aquifer testing. Successive measurements of groundwater levels over time in association with a long-term monitoring program may be used to assess seasonal and/or diurnal fluctuations, as well as the effects of any pumping wells on groundwater flow direction and gradient.

3.0 RESPONSIBILITES

The *Project Manager* is responsible for ensuring that groundwater measurements are implemented in accordance with this SOP and any other site-specific or project specific planning documents.

The *Field Personnel* are responsible for understanding and implementing this SOP during all field activities, as well as obtaining the appropriate field logbooks, forms and records necessary to complete the field activities.

The *Site Safety Officer (SSO)*, typically the supervising field manager, is responsible for overseeing the health and safety of employees and for stopping work if necessary to fix unsafe conditions observed in the field.

4.0 DEFINITIONS

Hydrograph - A plot of monitor well water level elevation versus time.

Potentiometric surface - The level to which water will rise in a cased well under atmospheric pressure conditions.

Reference Point - Survey marker at the top of the well casing, or other selected point, at which a water level is to be measured from.

5.0 REQUIRED MATERIALS

Planning for a groundwater level monitoring event entails assessing, selecting, and testing the types of equipment and supplies necessary to perform the scope of work. Listed below are the basic types of equipment and supplies used for the measurement of water levels.

5.1 Manual Measurement

The following materials are necessary for performing manual groundwater measurements.

- Water-level indicator (two-wire electrical sounder or conductivity meter), equipped with a sufficient length of cable to reach the deepest anticipated water level; the cable should be graduated into 0.01-foot intervals.
- Extra batteries for the water level indicator.
- Decontamination supplies (e.g., Alconox or other nonphosphate detergent, deionized or distilled water, brush, plastic bucket, clean spray bottles, paper towels, clean plastic sheeting) used for decontamination of the water level indicator, interface probe and cable, or steel tape.
- Keys for locked protective casings.
- Tools (e.g., wrenches), as needed, to enter well vault boxes.
- Health and safety monitoring equipment.

5.2 Continuous Measurement

The following materials are needed for conducting continuous measurements of groundwater levels.

- Electronic data logger (with the appropriate number of channels, a function of the number of wells to be monitored simultaneously).
- Water level indicator, (as described above).
- Pressure-sensitive transducers, including one barometric pressure transducer, that are compatible with both water quality and anticipated pressure-sensitivity range in a given well if total pressure measurements are made. (Note that some data loggers, e.g. Hermit 3000, have an internal barometric gauge). Alternatively, vented pressure-sensitive transducers can be used. Typically, vented transducers eliminate the need for a barometric pressure transducer; however, depending on study objectives, vented transducers may or may not be applicable. Also, transducer cables graduated into 0.01-foot intervals, if available.
- Decontamination supplies (as described above).
- Keys for locked protective casings.
- Tools, as needed, to enter well vault boxes.
- Health and safety monitoring equipment.

6.0 PROCEDURES

Groundwater level measurements in monitor wells shall be obtained manually using a two-conductor, battery-powered water level indicator (e.g., electrical sounder or conductivity meter) or steel surveyor tape. Continuous water level measurements, made in association with aquifer testing activities, may be obtained using an electronic data logger and pressure transducers (e.g., an In Situ Inc. Hermit, coupled with pressure transducer(s), Troll, or equivalent device).

6.1 Preparation for Monitoring Well Water Levels

In preparation for a monitoring event, the geologist/environmental engineer shall review the site-specific planning documents to obtain the following information:

- the identification number(s) of the well or wells to be monitored;
- the locations of the wells as shown on a site map;
- records listing the most recent water level measurements for the well(s) (if available);
- well access requirements (e.g., permission of owner, locked gates, locked wells, road conditions);
- reference point information (e.g., elevation of casing, location of reference point);
- the types of equipment needed to perform the scheduled monitoring activity;
- calibration requirements for the equipment (if applicable); and
- health and safety considerations, as appropriate.

A well monitoring form or similar form, shall be used to record groundwater level measurements and supporting information. In addition, fluid level measurements should be recorded in a bound field notebook.

6.2 Review of Existing Data

The geologist/environmental engineer may elect to prepare a hydrograph with the groundwater level data available for each well (or update an existing hydrograph) prior to going to the field. A hydrograph provides a visual record of groundwater level fluctuations over time. A hydrograph can be useful to identify any water level measurements that appear anomalous due to changes in conditions (e.g., a groundwater level rise due to a rainfall event or events, or a drop in water level due to initiation of pumping at a nearby well).

If groundwater levels are obtained at a regular frequency (e.g., monthly or quarterly), the geologist/environmental engineer may plot groundwater elevation contour maps based on the data obtained during each monitoring event at a given site. Changes in the interpretation of the potentiometric surface configuration may be readily observed when the contour maps are compared, and may be indicative of a change(s) in conditions in the hydrogeologic regime.

6.3 Well Inspection

Prior to obtaining a water level in a given well, its condition shall be inspected. Any signs of vandalism, unauthorized entry, or settlement and/or ponding around the well surface completion shall be noted.

6.4 Manual Water-Level Measurement

Prior to measuring depth to water, the well cover shall be removed and left off for at least three minutes prior to conducting measurements. Indications of air movement in or out of the well should be noted.

The probe of the electric water level indicator shall be lowered into the riser casing until water is encountered, as indicated by the instrument signal. The water level is then measured with respect to the "top-of-casing" reference point and entered on the field log. Two additional water level measurements shall be made to verify the initial reading obtained. It is good practice to visually inspect the measuring tape/probe to insure that it is not missing sections and the numbers are accurate. A periodic measurement of electric water level indicators using a measuring tape also is good practice.

The water level measurement shall be compared to the most recent water level obtained for the well (if any). If the measurements differ by more than 0.5-foot, the depth to water shall be measured a second time for verification purposes. A remark shall be made on the field log if a probable cause for the discrepancy is known (e.g., tidal fluctuation, rainfall event, or start-up of a nearby pumping well).

As indicated in Section 8, field measurements of water levels for a given well shall be recorded on the field form including the following information:

- the type of measurement device used;
- date and time of the measurement;
- any pertinent remarks concerning the well condition, instrument malfunction, variation of the sounded depth versus the installed depth of the well, etc.

A weighted steel tape can be used to sound the total depth of the well. Any discrepancy between the total well depth as compared to the constructed well depth shall be noted as a remark on the form; such a discrepancy may indicate the presence of a possible obstruction or break in the casing or sedimentation at the bottom of the monitor well. Use of an interface probe or electronic water level meter to sound the total depth of a monitor well should be avoided because of the difficulty in decontaminating the instrument cable.

6.5 Continuous Water Level Measurement

Continuous water level data may be required for certain field investigation activities such as aquifer testing. Electronic data loggers and transducers are typically used for continuous water level measurement.

6.5.1 Equipment Installation

An electronic data logger may be installed in one well with one transducer cable or may be connected to additional transducer cables that simultaneously monitor up to 15 additional nearby wells (the maximum transducer cable length currently available from one manufacturer [*In situ*, Inc.] is 4,500 feet). Standard transducer cables are made of polyurethane and are available for rental or purchase; however, Teflon cables are also available for purchase and rental.

If the data logger is not equipped with an internal barometer or vented pressure transducers are not being used, one of the transducers used should be a barometric pressure transducer. If a barometric pressure transducer is not available, a barograph may be used to gage changes in barometric pressure during the monitoring event that might impact water level measurements.

The electronic data logger and transducer cables shall be installed by the geologist/environmental engineer in accordance with the manufacturer's instructions. The data logger may be placed near a well or mounted on a post (if mounted on a post, the data logger shall be housed in a protective cabinet). A transducer cable shall be lowered into each well to be monitored and secured with plastic tie strips to the riser casing or protective well casing. The cable shall be positioned such that it does not interfere with closing and locking of the wells protective casing; also, the cable shall be positioned such that it is not pinched. If transducer cables are extended over areas that are heavily trafficked or mowed, they should be buried in a 6-inch-deep trench or strung through small-diameter, polyvinyl chloride (PVC) casing for protection. If cables are buried, their respective locations shall be flagged with survey laths and colored surveyor tape.

6.5.2 Equipment Calibration

Pressure transducers are available which require no field calibration (e.g., In-Situ Inc. PXD-260). If fluctuations in water level are anticipated over a range of less than 23 feet, a transducer rated at 10 pounds per square inch (psi) is appropriate. If a greater range of water level fluctuation is anticipated, the manufacturer's representative should be consulted as to the transducer psi rating required. Periodic manual measurement of water levels shall be performed as a check on the water level data recorded by a data logger.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

To promote consistency of data, water level measurements in a given well should be obtained with the same measuring device as used during previous monitoring events.

As a Quality Assurance/Quality Control (QA/QC) check on the accuracy of water level indicator measurements, the water level in a well may be obtained using a steel tape and carpenter’s chalk. Measuring water levels with a steel tape graduated to 0.01-foot is considered the most accurate method for obtaining water levels. Verification of data obtained with an electronic data logger shall be obtained by periodic (e.g., hourly or daily) manual water level measurement.

8.0 RECORDS

The geologist/environmental engineer shall submit copies of water and/or water/product levels forms to the Project Manager or designate immediately following the monitoring event for checking and revision purposes. The Project Manager or designate shall review and transmit the completed forms for incorporation into the project file.

9.0 REFERENCES

ASTM D 4750-87. 1988. Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well).

United States Environmental Protection Agency. 1986. RCRA Groundwater Monitoring Technical Enforcement Document, OSWER-9950.1.

United States Environmental Protection Agency. 1987. A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001.

10.0 ATTACHMENTS

None